International Journal of Trend in Scientific Research and Development (IJTSRD)
Volume 7 Issue 3, May-June 2023 Available Online: www.ijtsrd.com e-ISSN: 2456 – 6470

Proactive Maintenance for Pavement using Micro Surfacing

Shubham Gupta, Mr. Hariram Sahu

School of Engineering Eklavya University, Damoh, Madhya Pradesh, India

ABSTRACT

One of the areas of civil engineering with the quickest growth over the past ten years has been the field of materials treated with asphalt emulsion for road surface treatment. Understanding the field performance of materials treated with asphalt emulsion as well as the asphalt emulsion technology has received a lot of attention and study. The use of recycled materials, the impact of filler, the unique properties of the asphalt emulsion, and the mixture's rutting resistance are just a few of the aspects that need further experimental investigation, according to a review of research studies on micro-surfacing mixtures.

KEYWORDS: *emulsion, surface treatment, mix design, recycled materials, asphalt, resistance*

How to cite this paper: Shubham Gupta | Mr. Hariram Sahu "Proactive Maintenance for Pavement using Micro Surfacing" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-7 | Issue-3, June 2023, pp.194-197, URL: www.ijtsrd.com/papers/ijtsrd56234.pdf

IJTSRD56234

I. INTRODUCTION

In order to prevent extensive rehabilitation work on heavy traffic roads, micro surfacing was created in an effort to create a thicker slurry seal that could be employed in wheel tracks and ruts. To achieve this, premium aggregates and emulsions were mixed together to create a stable product that can be put in many stone thicknesses and resist rutting. Selected aggregates and bitumen were combined to create micro-surfacing, an asphalt emulsion treated material. Emulsifiers and polymers were then added, allowing the product to maintain its stability even when placed in several stone thicknesses. Micro surfacing is the uniform application of a mixture of polymerized bitumen emulsion, specially graded fine aggregates, cement, water, and additives over a properly prepared surface. The mixture is mixed homogeneously on site in a dedicated machine built specifically for the task. The road's surface qualities can be restored and preserved using the environmentally friendly surface treatment known as microsurfacing. It comes in two varieties: Type II, which is 4 to 6 mm thick, and Type III, which is 6 to 8 mm thick. It consists of a mixture of graded aggregate, cement, water, a polymer modified asphalt emulsion, and additives. With the aid of specialised paving machinery, this mixture is applied in a semi-liquid state. Resurfacing as a wearing course can be accomplished using microsurfacing. It is less expensive than hot mix treatment. Without altering the current profile, it provides a smooth surface. Although micro surfacing has long been used as a regular maintenance method in place of hot mix overlays, it wasn't until 1999–2000 that Yala Construction and Elsamex SA, Spain brought it to India under the brand name Macro Seal. Indian Road Congress (IRC), IRC: SP:81-2008 - Tentative Specifications for Slurry Seal and Micro surfacing, provide instructions on how to apply micro surfacing in India.

OBJECTIVE

Best on the present study following objectives are drawn.

- Provides great surface roughness and skid resistance; increases safety; and increases rider comfort.
- Environmentally friendly - no need for heating or hot paving, which reduces environmental pollution.
- Provides new wearing surface.
- Increases rider comfort, road life, and safety.

- Protecting natural resources.
- To offer affordable preventative maintenance for the pavement.
- A quicker laying procedure.

II. Literature review

(Robati et al., 2012) • Extends the life of the road and improves rider comfort and safety.

Actually, these techniques consider the same test methodologies for both systems without distinguishing between Slurry Seal and Microsurfacing mix design. Studies conducted by the Texas Transport Institute (TTI) demonstrated the issues with using the current micro-surfacing techniques and recommended the creation of a thorough mix design tailored specifically for micro-surfacing (TTI, 1995). In order to create a logical combination, the California Department of Transportation (Caltrans) has also investigated both Slurry Seal and Micro-surfacing technologies separately.

Extends the life of the road and improves rider comfort and safety.

Actually, these techniques consider the same test methodologies for both systems without distinguishing between Slurry Seal and Microsurfacing mix design. The design process was detailed in research by the Texas Transport Institute (TTI) (Caltrans, 2004). The minister de transport Quebec (MTQ) has created its own micro-surfacing definition. Similar standards and guidelines are used in the European Union to develop Slurry Seal and Micro-surfacing. Slurry Seal and Micro-surfacing systems have been used in several nations, including Germany, France, the United Kingdom, and South Africa, which have created particular rules for their usage. ISSA and ASTM are the standards that are most often utilised internationally among all of these others. 2018 (Petrova et al.) The creation of a contemporary, effective transport infrastructure that complies with international standards is given significant consideration in the governmental plan established for the growth of the building materials sector (Skvortsov, 2012). In Russia, asphalt concretes are now employed in the construction of roads. The asphalt concrete surface has a typical service life of around 10 years, however this can be affected by both natural and man-made influences, resulting in a shorter service life. In foreign nations, cement concrete roads are becoming more prevalent while asphalt concrete roads are steadily declining in percentage. Roads made of cement and concrete are increasingly used as arterials. In certain European nations, their percentage approaches 50%, while in the USA, it reaches 60%. Their share in Russia is currently between 2 and 3%. Decree No. 656 of the Government of the Russian Federation, dated 30 May 2017, established the target of increasing the interval between road surface inter-concrete surfaces that need to be repaired, from one to five years. Asphalt concrete surfaces can be replaced with more durable surfaces composed of alkali activated slag (cement-free) concrete in addition to cement concrete surfaces (et al., 2017; Petrova and Prokofieva, 2015). The aim of the study is to compare the corrosion resistance of Portland cement concrete and alkali activated slag concrete in corrosive oil-containing media. It has been shown that, after five years of observation, concrete with an alkali activated slag binder absorbed the corrosive medium at a rate that was 3.8 times lower than Portland cement concrete. This difference may be attributed to the unique characteristics of the alkali activated slag concrete structure. Alkali activated slag concrete has a 1.15 resistance coefficient in bending tests, whereas the resistance coefficient of In bending testing, Portland cement concrete scores 0.82. Therefore, it is proven that concretes made of alkali activated slag are more durable in corrosive oil-containing mediums.

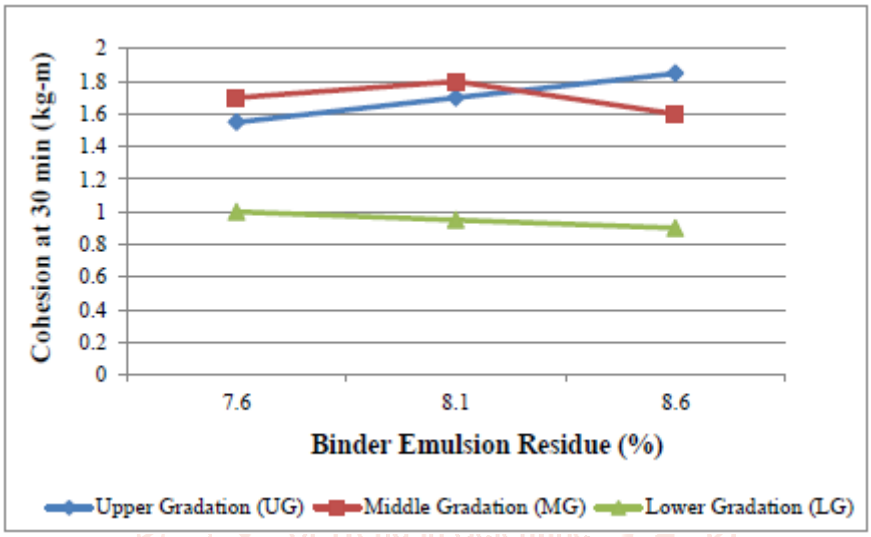
2018 (Anonymous) On the Brooklyn Bridge, microsurfacing was used for the pavement surfacing. The type III mix design was installed on the bridge's steel grid deck at night, and the results were good due to the heavy traffic and the requirement for quick condition timing.

2018 (Garfa et al.) Another research assessed the efficiency of type III microsurfacing in restoring old, rutted asphalt slabs. According to the study's findings, thermal ageing of the slabs improves the rutting resistance of hot mix asphalt that has undergone microsurfacing rehabilitation.

2019 (Salleh, et al.) Microsurfacing was used to restore the LATAR roadway as part of a Malaysian project. The findings after 36 months of operation revealed that microsurfacing significantly improved rutting, roughness, and skid resistance.

III. Grading of Aggregates

Sieve Size	% Passing (Minimum Layer Thickness)	
	Type II (4-6 mm)	Type III(6-8 mm)
9.5mm		100
6.3mm	100	90-100
4.75mm	90-100	70-90
2.36mm	65-90	45-70
1.18mm	45-70	28-50
600 micron	30-50	19-34
300 micron	18-30	12-25
150micron	10-21	7-18
75 micron	5-15	5-15



Graph 1. Plot of Raw data for Cohesion test at 30 min

IV. Conclusion

Based on the above study following conclusions can be made:

1. Under extremely acidic conditions (pH 2), where the majority of bitumen emulsion stabilisers undergo acid hydrolysis and lose their ability to stabilise the bitumen emulsions, the Bio Stab MY used in this study significantly improves storage stability of quick setting bitumen emulsion.
2. In comparison to EVA modification, SBS modification of limited penetration bitumen residue has better stiffness, suggesting greater resistance to loading. This can be explained by the fact that SBS modified bitumen is more elastic than EVA modified bitumen.
3. Unmodified low penetration bitumen emulsion produced bitumen residue that was stiffer than the original PG 58-28 bitumen. This suggests that it may be possible to create cold mix asphalt that is as rigid as traditional HMA mixtures.

References

[1] Kumar R, Ryntathiang T (2016) "New Laboratory Mix Methodology of Microsurfacing and Mix Design" 11th Transportation Planning and Implementation Methodologies for Developing Countries, TPMDC 2014, 10-12 December 2014, Mumbai, India.

[2] Y. Luo, K. Zhang, X. Xie, and X. Yao, "Performance evaluation and material optimization of microsurfacing based on cracking and rutting resistance" Construction and Building Materials, vol. 206, pp. 193–200, 2019.M. Young, The Technical Writer's Handbook. Mill Valley, CA: University Science, 1989.

[3] FHWA. (2005). Memorandum on Pavement Preservation Definitions.

[4] Uzarowski L. et I. Bashir. (2007). "A Rational Approach for Selecting the Optimum Binder Pavement Preventive and Rehabilitation Treatments–Two Practical Examples from Ontario". In Annual Conference of the Transportation Association of Canada. (Saskatoon).

[5] Singh, G. and Singh, J. (2008) Highway Engineering, Fifth Edition, Standard Publication Distributors, Delhi.

[6] Rigden, P. J. 1947. "The Use of Fillers in Bituminous Road Surfacings A Study of Filler-Binder Systems In Relation To Filler Characteristics". Journal of the Society of Chemical Industry.

[7] Einstein, A. 1956. "Investigation on the Theory of Brownian Motion". Analytical Physic.

[8] Traxler, R. N. 1961. "Asphalt: its Composition, Properties, and Uses", Reinhold, New York.

[9] Hixon, C. D., and D. A. Oten. 1993."Nine years of microsurfacing in Oklahoma", Transportation Research Record, no. 1392, pp. 13–19.

[10] Roger E. Smith, Colin K. Beatty, Joe W. Button, Steven E. Stacy, and Edward M. Andrews 1994, "USE OF MICRO-SURFACING IN HIGHWAY PAVEMENTS"

[11] Andrews, E., E. Smith, K. Beatty, and W. Button. 1995. "Evaluation of micro-surfacing mixture design procedures and the effects of material variation on the test responses." Research report 1289-1. Texas Department of Transportation (Federal Highway administration).

[12] Hicks, R. G. K. Dunn, and J. Moulthrop.1997. "Framework for selecting effective preventive maintenance treatments for flexible pavements", Transportation Research Record, no. 1597, pp. 1–10.

[13] Schilling P. 2002. "Success with bituminous emulsions requires a well-balanced chemistry of emulsions, bitumen and aggregate", In Proceedings of the International Slurry Surfacing Association Conference, Berlin, Germany.

[14] Takamura, K. (2000). SBR Synthetic Latex in Paving Applications. Bitumen Asia, pp. 20-21. Singapore.

[15] Ducasse, K., Distin, T., & Osborne, L. (2004). The Use of Microsurfacing as a Cost 285 Effective Remedial Action for Surface Rutting. 8th Conference on Asphalt Pavements for Southern Africa (CAPSA), Sun City, South Africa.